
HATCHERY EVALUATION REPORT

Round Butte Hatchery - Spring Chinook
December 1996

Integrated Hatchery Operations Team (IHOT)

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Round Butte Hatchery - Spring Chinook

An Independent Audit Based on Integrated Hatchery Operations Team (IHOT) Performance Measures

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Executive Summary

This report presents the findings of the independent audit of the Round Butte Hatchery - Spring Chinook program. Round Butte Hatchery is located on the Deschutes River at the base of Round Butte Dam, 10 miles west of Madras, Oregon. The Pelton Ladder is operated as a satellite rearing facility. The facility is a former fish passage ladder which has had some sections converted for fish rearing. The hatchery is used for adult collection, egg incubation, and rearing of spring chinook, summer steelhead, and brown trout.

The audit was conducted in 1996-1997 as part of a 2-year effort that will include 67 hatcheries and satellite facilities located on the Columbia and Snake River system in Idaho, Oregon, and Washington. The hatchery operating agencies include the U.S Fish and Wildlife Service, Idaho Department of Fish and Game, Oregon Department of Fish and Wildlife, and Washington Department of Fish and Wildlife.

Background

The audit is being conducted as a requirement of the Northwest Power Planning Council (NPPC) "Strategy for Salmon" and the Columbia River Basin Fish and Wildlife Program. Under the audit, the hatcheries are evaluated against policies and related performance measures developed by the Integrated Hatchery Operations Team (IHOT). IHOT is a multi-agency group established by the NPPC to direct the development of new basinwide standards for managing and operating fish hatcheries. The Bonneville Power Administration (BPA) contracted with Montgomery Watson to act as an independent contractor for the audit.

IHOT has established five basic policies that cover: (1) hatchery coordination, (2) hatchery performance standards, (3) fish health, (4) ecological interaction, and (5) genetics. The audit focuses on all these policies, with the exception of hatchery coordination. These policies are set forth in *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries (IHOT 1995)*. That document is the source for the performance measures that are the basis of this audit.

The Audit Process

The audit was based on the facility management's response to a 109-page questionnaire. This audit form was completed through a five-step process in which:

- Information was obtained from headquarters.
- The hatchery manager was asked to fill out and return the audit form.
- A 1-2 day site audit visit was conducted to inspect facilities, review hatchery records, discuss audit form responses, and develop remedial action plans.

- A compliance report was developed to document the compliance status of each performance measure. This report was then shared with the hatchery manager and IHOT representative.
- This hatchery evaluation report was written to document compliance with IHOT performance measures and develop cost estimates for remedial actions when needed.

Round Butte Hatchery - Spring Chinook Results

The Round Butte facility includes 2 ponds for adult holding, 10 concrete raceways, 30 circular tanks, 1 rearing pond (at Pelton Ladder), and incubation facilities. Round Butte Hatchery was constructed in 1972 to mitigate for the fisheries losses caused by Pelton/Round Butte Hydroelectric Complex.

The Round Butte Hatchery - Spring Chinook program was in general compliance with most of the performance measures. In the area of program objectives, the hatchery was not meeting its adult return goal and needed to develop green-eyed to eyed-egg and eyed-egg to fry survival goals for the IHOT Operations Plan. The audit found that the hatchery was not in compliance with the water quality monitoring requirements, disease-free water requirement for incubation and early rearing, alarm requirements, and regional oversight of feed production, which are all facilities requirements. The hatchery needed to develop specific incubation and rearing standards for the IHOT Operations Plan. The hatchery was not meeting the loading and flow criteria for incubations. The hatchery was not monitoring smoltification, needed rearing or acclimation in the Hood and Deschutes River subbasins, and was not following the IHOT protocols for transportation. In the compliance area for fish health policy, the hatchery did not have foot baths in the incubation facilities.

The specific areas in which the Round Butte Hatchery - Spring Chinook program requires remedial actions based on the IHOT performance measures are listed below. These remedial actions are listed in alphabetical order without intent of ranking or otherwise assigning priority:

- Develop alarm log
- Develop green-egg to eyed-egg and eyed-egg to fry survival goals for IHOT Operations Plan
- Develop smoltification goal and monitor
- Develop specific incubation and rearing standards for the IHOT Operations Plan
- Follow IHOT protocols for checking alarms
- Follow IHOT protocols for feed handling
- Follow IHOT recommendations for disinfection of tank interiors
- Follow IHOT recommendations for disinfection of transport equipment before and after use.
- Follow IHOT recommendations for QA/QC for feed preparation
- Follow IHOT protocols for disinfection of the exteriors and interiors of vehicles
- Follow IHOT protocols for equipment disinfection
- Follow IHOT protocols for wearing protective garments when handling fish eggs or cultural water
- Improve pre-spawning survival

- Provide disinfection for incubation and early rearing
- Provide foot baths for incubation facilities
- Review IHOT loading and flow criteria for incubation
- Review IHOT temperature criteria for hauling or change hauling temperature
- Review IHOT temperature criteria for rearing
- Run analysis for missing water chemistry parameters, nitrite, and contaminants

Non-compliance issues resulting from items beyond human control or Performance Measures not relevant to this hatchery (Type 1 in Table 3, Section 4 of this report) were not listed above.

Facility Description

Name:	Round Butte Hatchery
Stock/Species:	Summer Steelhead Spring Chinook Brown Trout
Operating Agency:	Oregon Department of Fish & Wildlife
Funding Agency:	Portland General Electric (PGE)
Location:	Round Butte Hatchery is located on the Deschutes River at the base of Round Butte Dam, 10 miles west of Madras, Oregon. The Pelton Ladder is operated as a satellite rearing facility. The facility is a former fish passage ladder which has had some sections converted for fish rearing.
Address:	Round Butte Fish Hatchery Oregon Department of Fish & Wildlife P.O. Box 15 Madras, OR 97741
Hatchery Manager:	Mr. Bill Nyara
Phone:	(541) 475-6393
Fax:	(541) 475-4605
Purpose:	Round Butte Hatchery was constructed in 1972 to mitigate for the fisheries losses caused by Pelton/Round Butte Hydroelectric Complex.
Production Goal:	Summer Steelhead Produce 162,000 smolts (40,5000 lb) for release into the Deschutes River Spring Chinook Produce 454,404 smolts (51,622 lb) for release into the Deschutes and Hood rivers.

Water Supply:

Water is supplied to the hatchery from tunnels in the canyon wall that collects seepage from the upstream reservoir.

Facilities:

Adult Holding: 2 concrete adult holding ponds - 2,720 cf each

Incubation: 32 vertical stack incubators (256 trays)

Early Rearing: 30 circular tanks - 71 cf each

1 oval raceway - 310 cf

Raceways: 10 Burrows raceways - 3,950 cf each

Rearing Ponds: None

Satellite Facilities: Pelton Ladder

Fish ladder section modified into 6 rearing units (161,250 cf total).

Section 3

Compliance Status

The hatchery audits are based on compliance with written IHOT performance measures. These performance measures are documented in *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries* (referred to as *IHOT 1995* in this report).¹ The purpose of the performance measures is to implement new basinwide policies that provide regional guidelines for operating anadromous hatcheries in the Columbia Basin.

The audit focuses on performance measures for IHOT policies that cover (1) hatchery performance standards, (2) fish health, (3) ecological interaction, and (4) genetics. These performance measures are intended to guide hatchery operations once production is established. For that reason, the hatchery operations audit included broodstock collection, spawning, incubation of eggs, fish rearing and feeding, fish release, equipment maintenance and operations, and personnel training. Production priorities are beyond the scope of this audit.

Based on *IHOT 1995*, a detailed 109-page audit form was developed. The audit form divided the performance measures into six major sections along major program and technical criteria areas. Two additional sections (sections 1 and 8) include general information and expenditure information needed for this Hatchery Evaluation Report and blank forms for additional comments. The following is the basic structure of the IHOT audit form:

Section 1	Performance Measures for General Information and Expenditure Information (PMs General 1-2)
Section 2	Performance Measures for Program Objectives (PMs 1-4)
Section 3	Performance Measures for Facility Requirements (PMs 5-15)
Section 4	Performance Measures for Hatchery Practices (PMs 16-25)
Section 5	Performance Measures for Fish Health Policy (PMs 26-34)
Section 6	Performance Measures for Ecological Interactions (PMs 35-38)
Section 7	Performance Measures for Genetics Policy (PMs 39-43)
Section 8	Blank Forms for Additional Comments

Several performance measures are repeated in various sections of the audit form. These performance measures overlap in *IHOT 1995* and were retained to allow individuals interested in specific portions of the audit (such as Genetics or Fish Health) to determine the compliance status of all performance measures for a given topic in one location. A repeated performance measure is indicated by shaded text.

The Hatchery Audit Process

¹Integrated Hatchery Operations Team (IHOT) 1995. *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries*, Bonneville Power Administration, Portland, Oregon.

The hatchery audit will be conducted over a 2-year period that concludes in 1997. At each hatchery, a five-step process was used to complete the overall hatchery audit. This process consisted of research and onsite visits. The site visit at the Round Butte Hatchery was conducted on October 28, 1996.

The following is the five-step audit process:

1. Information was obtained from headquarters.
2. The hatchery manager was asked to fill out and return the **Audit Form**.
3. A 1-2 day site audit visit was conducted at each hatchery. During that visit an audit team inspected facilities, reviewed hatchery records, discussed audit form responses, and developed remedial action plans when appropriate.
4. During the site visit, the compliance status of each performance measure was discussed with the hatchery manager and IHOT representative. A portion of the Hatchery Evaluation Report was sent to the hatchery manager following the audit visit as a **Compliance Report**. That Compliance Report is Table 2 of this report.
5. Information from steps 1-4 was used to prepare a draft **Hatchery Evaluation Report**. This draft report was submitted to the operating agencies for review of the information used to determine compliance. Based on review and comments, a final Hatchery Evaluation Report was developed. The final report documents the compliance of a particular hatchery with the IHOT performance measures and presents cost estimates to correct any deficiencies.

Compliance Status of Round Butte Hatchery - Spring Chinook

The following table includes information on life-stages that are held on this facility for some portion of their rearing cycle (Table 1). For multi-facility programs, summary cost and contribution data is presented at the facility where rearing occurs. For the compliance status relating to performance measures that do not occur at this hatchery, please refer to the Hatchery Evaluation Reports for the hatcheries and stocks listed in Table 1. A check mark (✓) indicates that the specific life-stage is held at this facility.

This section documents the compliance status of the Round Butte Hatchery - Spring Chinook program. Each performance measure is presented in a table taken from the audit form (Table 2). The compliance status is identified by the following categories:

- **N/A** (not applicable)
- **Yes** (in compliance)
- **?** (unknown; generally due to unavailability of information to determine compliance)
- **No** (not in compliance).

Remedial actions are suggested for performance measures not in compliance. These remedial actions are grouped into categories and listed in Section 4 of this report, where the cost of the required remedial actions is also presented.

Table 1 Summary Program Information for Round Butte Hatchery - Spring Chinook

Component	Location of Adult Holding, Spawning, Incubation, and Rearing					
	Pelton Trap	Round Butte Hatchery	Pelton Ladder	West Fork Hood River		
Adult Collection	✓					
Adult Holding		✓				
Spawning		✓				
Fertilization		✓				
Incubation						
green-to-eyed		✓				
eyed-to-hatch		✓				
Rearing		✓				
fry		✓				
fingerlings		✓	✓			
smolts		✓	✓			
Acclimation/release			✓	✓		

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#1	Are the hatchery programs outlined in a subbasin management plan?		✓			Columbia Basin System Planning Production Plan and Lower Deschutes River Subbasin Fish Management Plan. Also Pelton Ladder Master Plan	
#2	Is the hatchery operating under a current hatchery operational plan? Is it understood by staff? Is it being followed?		✓ ✓ ✓			IHOT Operations Plan and Round Butte Hatchery Manual ODF&W Fish Productions Schedule	
#3	Is a hatchery monitoring and evaluation plan in place? Do you have a written monitoring and evaluation plan?		✓			In Pelton Ladder Master Plan	
#4a	Adult contribution to fisheries, spawning grounds, and hatchery		✓			Review of records	
#4b	Adult pre-spawning survival as compared with established goal				✓	Review of records; in compliance 2 out of last 5 years	Improve pre-spawning survival
#4c	Egg-take as compared with established hatchery goal		✓			Review of records; in compliance 5 out of last 5 years	
#4d	Green-egg to eyed-egg survival as compared with established goal			✓		No IHOT goal	Develop green-egg to eyed-egg goal for IHOT Operations Plan
#4e	Eyed-egg to fry survival as compared with established goal			✓		Review of records; in compliance with hatchery goal. No IHOT goal	Develop eyed-egg to fry goal Operations Plan
#4f	Fry to smolt survival as compared with established goal		✓			Review of records; in compliance 3 out of last 3 years	
#4g	Production as compared with established goal		✓			Review of records; in compliance 3 out of last 3 years	
#4h	Percent survival (smolt to adult) as compared with established goal				✓	Review of records; in compliance 3 out of last 5 years. PGE's written requirements is 0.5% for smolt-to-adult survival. Based on returning 1200 adults to Pelton Ladder	Improve adult returns

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#4i	Number of eggs, fry, fingerlings, smolts, and/or adults to meet basinwide needs	✓				Review of records/Discussion	

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#5a	Temperature						
	Does your water temperature meet the criteria for spawning?		✓			Review of records/Discussion. Water temperature is a constant 51°F from infiltration gallery	
	Does your water temperature meet the criteria for incubation?		✓			Review of records/Discussion. OK on average. Max/min sometimes higher	
	Does your water temperature meet the criteria for rearing?				✓	No problems experience	Review IHOT temperature for rearing
#5b	Dissolved gases						
	Is the oxygen level near saturation?		✓			Review of records/Discussion	
	Is the dissolved nitrogen level less than saturation?		✓			Review of records/Discussion	
#5c	Chemistry						
	Ammonia (un-ionized)			✓		No data	Run analysis
	Carbon Dioxide				✓	Reported at 2.9 mg/L	Run analysis to confirm data
	Chlorine			✓		No data	Run analyses
	pH		✓			Review of records/Discussion	
	Copper			✓		Data reported for “below detection limit” for Cu, Fe, Zn. However, limits used higher than IHOT criteria. Need to re-run to compare with IHOT criteria	Run analysis
	Hydrogen Sulfide			✓		See above	Run analysis
	Iron			✓		See above	Run analysis
	Zinc			✓		See above	Run analysis
#5d	Turbidity						
	Does your turbidity meet the criteria?		✓			Seepage through dam into infiltration gallery. No problems	

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#5e	Alkalinity and hardness Does your alkalinity and hardness meet the criteria?		✓			Review of records/Discussion	
#5f	Nitrite Does your nitrite meet the criteria?			✓		No data	Run the analysis
#5g	Contaminants Aldrin Endrin Dieldrin Heptachlor Chlordane Methoxychlor Lindane Malathion Guthion			✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓		No data No data No data No data No data No data No data No data No data No data	Run the analysis See above See above See above See above See above See above See above See above See above
#5h	Pathogens What portions of the hatchery have disease-free water? Adult holding Incubation Early rearing Rearing Others				✓ ✓ ✓ ✓ ✓	Inspection of facilities/Discussion Inspection of facilities/Discussion Inspection of facilities/Discussion Inspection of facilities/Discussion Inspection of facilities/Discussion	None Provide disinfection for water incubation/early rearing See above See above See above

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#6	Alarm Systems						
	Do the following areas have alarms?						
	Intake	✓				Inspection of facilities/Discussion Infiltration gallery	
	Large rearing ponds and adult holding ponds		✓			Inspection of facilities/Discussion	
	Raceway headboxes and rearing ponds		✓			Inspection of facilities/Discussion	
	Incubation facilities		✓			Inspection of facilities/Discussion	
	Quarantine areas and facilities	✓				None on station	
	Water treatment systems		✓			Inspection of facilities/Discussion	
	Security				✓	Site is remote and very secure	Install security alarms
#7	Are there outside systems and buzzers in onsite residences?				✓	Discussion. Alarms sound in Pelton Powerhouse with 24-hour staffing. They notify hatchery staff	None
	Are water flow alarms checked daily?				✓	Review of records/Discussion	Follow IHOT protocols for cl alarms
	Are all other alarms checked weekly?				✓	Discussion	See above
	Is there a log of alarms for emergencies, tests, and maintenance requirements?				✓	Review of records/Discussion	Develop alarm log
	Are telephone pagers used?		✓			Discussion	
#7	Adult collection and holding facilities						
	Do you meet the adult holding criteria?		✓			Review of records/Discussion	

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#12	Food storage facilities and quality control						
	Does the storage of dry/semi-moist/moist foods (dry<12%; semi-moist 12-20%; moist >20% moisture) follow food manufacturer's recommendations?		✓			Inspection of facilities/Discussion	
	Does a regional quality control officer oversee production procedures and monitor:						
	Verification by feed manufacturer that ingredients meet specifications?				✓	Discussion	Follow IHOT recommendations for production QA/QC and monitoring
	Ensure feed does not contain unwanted drugs or other additives?				✓	Discussion	See above
	Analyze ingredients contained in the final food product to ensure that feed specifications have been met?				✓	Discussion	See above
	Are the foods stored and handled according to the following criteria?						
	Moist pellets should not exceed 10°F at point of delivery.		✓			Discussion	
	Moist pellets should be removed from freezer just prior to feeding.				✓	Discussion. Weigh out afternoon before; store in thaw room	Follow IHOT protocols on feed storage
	Do not leave buckets of feed or feed containers outside exposed to light or heat.		✓			Discussion	
	Open bags of feed should be fed within 1 to 2 days except when feeding small groups of fish.		✓			Discussion	
	Automatic feeder hoppers and bulk storage facilities should be insulated against excessive temperatures (80°F and above).		✓			Discussion	

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#13	Release facilities Do the release facilities ensure that fish are not subjected to adverse conditions?		✓			Inspection of facilities/Discussion	
#14	Pollution abatement facilities Do the pollution abatement facilities meet all federal and state regulations (or good engineering practice)?	✓				Inspection of facilities. Meet applicable NPDES water quality criteria with no treatment. No facilities required	
	Are pollution abatement facilities operated correctly?	✓				Discussion	
#15	Transportation facilities Are the transport systems adequate to meet IHOT performance measures for transportation practices?		✓			Inspection of facilities/Discussion	

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#16	Broodstock selection practices						
	Is the donor selection process document attached? (PM #40a)	✓				Existing program; does not apply	
	Was the donor selection outline followed in selecting the hatchery broodstock? (PM #40b-c)	✓				Existing program; does not apply	
#17	Spawning practices						
	Were the appropriate number of spawners, male/female ratios, and fertilization protocols used? (PM #42c-g)				✓	Ability to sex adult not possible during most of collection. Male:female ratios less than 1:1 in some years	See PM #42
#18	Incubation practices						
	Are specific incubation standards listed in the hatchery operations plan?		✓			Reviewed IHOT Operations Plan and Round Butte Hatchery Manual	Develop specific incubation standards for IHOT Operations Plan
	Are incubation practices written?		✓			Review written incubation	
	Incubation Type 1: Vertical (see PM #8) Do you meet the loading and flow criteria?				✓	Do not meet IHOT loading and flow criteria. No problems experienced. Experience shows 6 gpm too high for the units	Review IHOT loading and flow for incubation
	Incubation Type 2 (see PM #8) Do you meet the loading and flow criteria?	✓					

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#19	Rearing practices						
	Are specific rearing standards listed in the hatchery operations plan?		✓			Review IHOT Hatchery Operations Plan and round Butte Hatchery manual	Develop specific rearing standards in IHOT Operations Plan
	Are rearing practices written?		✓			Review Hatchery Operations Plan	
	Rearing Unit Type 1: Circular Tanks (see PM #9)						
	Do you meet the density and DI criteria?		✓			Review of records/Discussion	
	Do you meet the Loading and FI criteria?		✓			Review of records/Discussion	
	Rearing Unit Type 2: Raceways (see PM #9)						
	Do you meet the density and DI criteria?		✓			Review of records/Discussion	
	Do you meet the Loading and FI criteria?		✓			Review of records/Discussion	
#20	Smolt quality						
	Do you produce a high quality smolt?		✓			Discussion	

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#21	Fish health management practices						
	Are the monthly hatchery monitoring visits being conducted? (PM #26)		✓			Review of records/Discussion	
	Are the annual broodstock inspections being conducted? (PM #27)		✓			Review of records/Discussion.	
	Is there pathogen-free water and are the sanitation procedures being followed? (PM #28)				✓	Review of records/Discussion. No pathogen-free water	Provide pathogen-free water for incubation and early rearing
	Are the following water quality parameters within criteria? (PM #5a-5g)						
	Water temperature				✓	Exceed rearing criteria; no problems	See PM #5a
	Dissolved gases		✓			Review of records/Discussion	
	Chemistry				✓	No data for some parameters	See PM #5c
	Turbidity		✓			Supply from dam seepage	
	Alkalinity and hardness		✓			Review of records/Discussion	
	Nitrite			✓		No data	See PM #5f
	Contaminants			✓		No data	See PM #5g
	Are rearing standards being followed? (PM #19)		✓			Review of records/Discussion	
	Are egg and fish transfer/release requirements met? (PM #31)		✓			Review of records/Discussion	

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#22a	Does hatchery performance meet requirements outlined in the regional hatchery policies and in subbasin and hatchery plans for the following areas?						
#22a1	Percent smoltification Do you measure percent smoltification? Did you meet the smoltification criteria?				✓ ✓	Discussion Discussion	Develop smoltification criteria implement program to measure See above
#22a2	Rearing density (prior to release) Did you meet the rearing density criteria just prior to release?		✓			Review of records/Discussion	
#22a3	Disease condition (at release) Did you meet all disease regulations just prior to release?		✓			Review of records/Discussion	
#22a4	Number (at release) Did you meet the release number goal?		✓			Review of records/Discussion	
#22a5	Size at release Did you meet the size goal?				✓	Some mixing of lots of different sized fish because seals on screens failed; allow fish to move between cells.	None. Facility problem corrected
#22a6	Dates of release Did you meet the release date goal?		✓			Review of records/Discussion	
#22a7	Location of release Did you release the fish at the specified location?		✓			Review of records/Discussion	
#22b	Are fish reared in the subbasin or acclimated in the subbasin? Are the fish reared in the subbasin? Are the fish acclimated in the subbasin?		✓ ✓			Discussion. Discussion	

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#23	Transportation facilities						
	Do transportation equipment and personnel receive disinfection before and after use?				✓	Discussion	Follow IHOT recommendations for disinfection of transportation before and after use.
	Is the fish tank interior disinfected using a solution of 200 ppm active chlorine for 30 minutes minimum or formaldehyde gas generation method (relative humidity of 60% for 2 hrs)?				✓	Discussion	Follow IHOT recommendations for disinfection of tank interiors
	Is the exterior of the fish transport vehicle disinfected using high pressure steam (115-130°C), high temperature acid, or with 200 ppm chlorine for 30 minutes?				✓	Discussion	Follow IHOT protocols for disinfection of the exteriors and interiors of fish transport vehicles
	Is the fish transport vehicle (cab) disinfected using 600 ppm quaternary ammonia compounds (1.5 ml of 50% stock solution/liter water)?				✓	Discussion	See above
	Is other equipment disinfected including fish pumps, nets, egg sorters, waders, boots, rain gear, hoses and other equipment using one of the following solutions?				✓	Discussion	Follow IHOT protocols for disinfection of equipment
	200 ppm chlorine for 30 minutes 600 ppm quaternary ammonia compound for 30 minutes 200 ppm iodophor solution for 10 minutes					Discussion	
	Do personnel wear protective garments when handling fish eggs or cultural water?				✓	Discussion	Follow IHOT protocols for wearing protective garments when handling fish eggs or cultural water
	Do the fish transport truck/chassis and tank/unit receive an inspection and service prior to the release season?		✓			Discussion	
	Is a daily service inspection completed before starting up and leaving for the day?		✓			Discussion	

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#23 (cont)	Transportation facilities						
	Does the fish transport unit receive an inspection prior to loading?		✓			Discussion	
	Does a pre-loading inspection covering tank water level, pumps or aerators, oxygen injection system settings, displacement gauge, and truck loading/hauling density tables checked and reviewed occur prior to loading fish in the transport unit?		✓			Discussion	
	Do hauling criteria include checking the fish 45 minutes to 1 hour after loading?		✓			Discussion	
	When fish are active and systems are functioning properly, is the oxygen concentration reduced and maintained at approximately 8 ppm?		✓			Discussion	
	Is water temperature in the transportation unit maintained within the 42-48 °F range?				✓	Discussion. Ambient is 51 °F	Review IHOT temperature or hauling or change hauling ter
	Do fish releasing procedures include the following criteria?						
	Releasing the fish at the correct release site or into the correct water body.		✓			Discussion	
	Tempering or the difference between the liberation tank and the target water body should not exceed 10°F.		✓			Discussion	
	The liberation hose should be angled so that fish gently hit the water. Using a tripod is a method of ensuring the hose will stay at the proper angle.		✓			Discussion	

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#24	Evaluation practices						
	Has the hatchery conducted fishery contribution studies to:						
	Determine the requirements for evaluating and improving management programs?		✓			Discussion	
	Develop guidelines that define the geographical area and identify component stocks (hatchery and/or wild) that comprise the management unit?		✓			Discussion	
	Develop guidelines that define if the proper stocks of fish are currently being used?		✓			Discussion	
	Determine which management units contribute to a specific fishery and the time periods of those contributions?		✓			Discussion	
	Determine the relative contributions of the various management units to a specific fishery over the different time periods?		✓			Discussion	

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#25	Training practices						
	Does the hatchery have a training schedule for its staff?		✓			Review of records/Discussion	
	Does each staff member have a personal training plan approved by a supervisor and reviewed annually?		✓			Review of records/Discussion	
	Does the hatchery routinely exchange training details between other hatcheries and agencies?		✓			Review of records/Discussion	
	Does the hatchery encourage and reward off-duty training of staff?		✓			Review of records/Discussion	
	Does the hatchery conduct monthly staff meetings?		✓			Review of records/Discussion	

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#26	Are monthly hatchery monitoring visits being conducted by a qualified fish health specialist as described below?						
	Conduct visit at least monthly		✓			Review of records/Discussion	
	Monitoring conducted by qualified fish health specialist		✓			See above	
	Examine a representative sample of healthy and moribund fish from each lot.		✓			See above	
	Review fish culture practices with hatchery manager.		✓			See above	
	Report finding and results of necropsies on standard form.		✓			See above	
	Recommend appropriate drug or chemical treatment.		✓			See above	
#27	Are all of the functions of the hatchery yearly monitoring visits being completed as described below?						
	Annually examine each broodstock for the presence of reportable viral pathogens.		✓			Review of records/Discussion	
	Annually screen each salmon broodstock for the presence of <i>Renibacterium salmoninarum</i> .		✓			See above	
	Conduct inspection by or under the supervision of qualified fish health specialist.		✓			See above	

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#28	Is the hatchery following accepted sanitation procedures?						
	Are there any sources of pathogen-free water, especially for incubation and early rearing?				✓	Discussion/Inspection	Provide pathogen-free water for incubation and early rearing
	Are the hatchery sanitation procedures understood and being followed as described below?						
	Disinfect/water harden eggs in iodophor?		✓			Inspection of facilities/Discussion	
	Are foot baths containing disinfectant placed at the incubation facility's entrance and exit?				✓	Inspection of facilities/Discussion	Provide foot baths
	Is equipment and rain gear utilized in broodstock handling or spawning sanitized prior to its use elsewhere in the hatchery?		✓			Inspection of facilities/Discussion	
	Is equipment used to collect dead fish sanitized prior to its use in another pond and/or lot of fish?		✓			Inspection of facilities/Discussion	
	Is equipment, including vehicles used to transfer fish between facilities, disinfected prior to use with any other fish lots or at any other location?		✓			Inspection of facilities/Discussion	
	Are rearing vessels sanitized after fish are removed and prior to introducing a new fish lot or stock?				✓	Circular tanks are disinfected; raceways are not. No disease transmission problems	None
	Are dead fish properly disposed of?		✓			Inspection of facilities/Discussion	

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#29	Are water quality parameters being followed? Are the following water quality parameters within criteria? (PM #5a-5g) Water temperature Dissolved gases Chemistry Turbidity Alkalinity and hardness Nitrite Contaminants Go to PM #21		✓ ✓ ✓	✓ ✓	✓ ✓	Rearing temperatures exceed criteria. Review of records/Discussion No data for some parameters Dam seepage; no turbidity Review of records/Discussion No data No data	See PM #5a See PM #5c See PM #5f See PM #5g
#30	Are incubation and rearing standards being followed? Are the incubation practices following the IHOT incubation criteria? (PM #18) Are the rearing practices following the IHOT criteria? (PM #19) Go to rearing practices PM #18-PM #19		✓ ✓		✓ ✓	Review of records/Discussion Review of records/Discussion	See PM #18
#31	Are egg and fish transfer/release requirements met?		✓			Discussion	

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#32	Is the hatchery's program outlined in a subbasin management plan? Go to subbasin plan PM #1		✓			Columbia Basin System Planning Production Plan and Deschutes River Subbasin Management Plan	
#33	Is the hatchery operating under a current hatchery operational plan? Go to operational plan PM #2		✓			Review IHOT Operations Plan and Round Butte Hatchery Manual	
#34	Is a hatchery monitoring and evaluation plan in place? Go to hatchery monitoring and evaluation plan PM #3		✓			M&E program described in Pelton Ladder Master Plan	

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance				
		N/A	Yes	?	No						
#35	Does the hatchery program meet requirements established in the regional hatchery policies and subbasin planning documents in the following areas: species, stock, broodstock collection location, broodstock numbers, broodstock collection strategy, and spawning and egg-take protocols?										
	Does the hatchery program meet the requirements for the following?										
	Species protocols (PM #4a)							✓			
	Stock protocols (PM #4a)							✓			
	Broodstock collection location protocols (PM #41b)							✓			
	Broodstock numbers protocols (PM #42c)								✓	Review of records/Discussion	See PM #42c
	Broodstock collection strategy protocols (PM #41b-d)							✓		Review of records/Discussion	
	Spawning protocols (PM #42d-e)								✓	1:1 ratio not always met	See PM #42e
Egg-take protocols (PM #42f-g)			✓	Review of records/Discussion	See PM #42f						

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#36	Does the hatchery's performance meet requirements outlined in the regional hatchery policies and in subbasin and hatchery plans for the following areas: percent smoltification, rearing density, disease condition, and the number, size date(s), and location of release?						
	Percent smoltification (PM #22a1)				✓	Review of records/Discussion. Do not measure	See PM #22a1
	Rearing density (PM #22a2)		✓			Review of records/Discussion	
	Disease condition (PM #22a3)		✓			Review of records/Discussion	
	Number at release (PM #22a4)		✓			Review of records/Discussion	
	Size at release (PM #22a5)				✓	Discussion.	See PM #22a5
	Date of release (PM #22a6)		✓			Review of records/Discussion	
	Location of release (PM #22a7)		✓			Review of records/Discussion	
#37	Are fish reared in the subbasin or acclimated in the subbasin?		✓			Discussion	
	See PM #22b						
#38	Is the release strategy appropriate for the program?		✓			Discussion	
	See PM #22c						

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#39	For new programs, has a broodstock collection plan been developed? Is the broodstock collection plan written? For a non-captive broodstock program: Was an unbiased, representative sample collected? Was the recommended number of broodstock collected? For a captive broodstock program: Were captive brood progeny excluded as donors for propagating the next generation of the captive broodstock program? Were full-sib crosses avoided? Is the broodstock collection plan understood and being followed by staff?	 ✓ ✓ ✓ ✓ ✓ ✓				 Existing Program; does not apply Existing Program; does not apply Existing Program; does not apply Existing Program; does not apply Existing Program; does not apply Existing Program; does not apply	
#40	For a new program, was the donor selection outline followed in selecting the hatchery broodstock?						
#40a	Is a donor selection plan written?	✓				Existing Program; does not apply	
#40b	Was the donor selection outline followed in selecting the broodstock?	✓				Existing Program; does not apply	
#40c	Was the target stock recommended in the donor selection process actually used?	✓				Existing Program; does not apply	

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#41	For existing programs, were the broodstock collection procedures followed?						
#41a	Is the broodstock collection plan written?		✓			Review broodstock collection plan	
	Does the broodstock collection plan follow the guideline:						
#41b	Was an unbiased, representative sample collected?		✓			Discussion. Typically OK; see also PM#42C.	
#41c	Was the recommended number of broodstock collected?		✓			Discussion	
#41d	Were the broodstock collection procedures in hatchery operation plan understood and followed?		✓			Discussion	

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#42	Was the appropriate number of spawners, male/female ratios, and fertilization protocols used?						
#42a	Are the spawning protocols written?		✓			Pelton Ladder Master Plan page 12. and IHOT Operations Plan page 232	
#42b	Are daily or weekly spawning logs available?		✓			Review of records	
#42c	Was the appropriate number of spawners used?				✓	No problem during “normal” run years. Over sample males during July to make up the difference. During “short” years, cannot get enough to satisfy a 1:1 spawning ratio. No remedial action other than to improve adult ocean survival so the run size stays high	Improve adult returns
#42d	Did you attempt to spawn all collected broodstock and randomize mating with respect to age class, and other traits?		✓			Discussion	
#42e	Was the sex-ratio within the limits given in the performance standards?				✓	Varied because of inability to sex fish	Improve adult returns
#42f	Were the fertilization protocols followed?				✓	Varied because of unequal numbers of females to males.	Improve adult returns
#42g	If the hatchery needed to reduce the number of eggs retained, was this done by representative sampling of each male/female cross?	✓				Not needed	

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#43	Is there a genetics monitoring and evaluation program in place?						
	Is a genetics monitoring and evaluation program available?		✓			Pelton Ladder Master Plan pages 22 and 40	
	Does the plan address the following elements listed in IHOT:						
	Does the program have elements needed to meet evaluation goals 1-4?		✓			Discussion	
	Has a qualified geneticist reviewed and endorsed the program (goal 5)?		✓			Discussion	
	Will the program collect the data and maintain the records needed to evaluate compliance on an ongoing basis (goal 5)?			✓		Results not yet available to answer the question. Continue program and evaluate results	None
	Is the program understood and followed by staff?		✓			Discussion	

Remedial Actions

Based on the compliance status for each performance measure, remedial actions were developed. The required remedial actions are organized into five categories. The types of categories range across a spectrum from those actions that are beyond human control, to those that require a change in agency policy or procedures, to those that involve a significant capital cost to put in place. The following are the five types of remedial actions identified under phase 1 of the audit:

The Five Types of Remedial Actions

Type	Description
1	Non-compliance issues resulting from items beyond human control or Performance Measures not relevant for this hatchery
2	Remedial actions requiring changes in agency policies or procedures
3	Remedial actions requiring changes in monitoring coverage or interval
4	Remedial actions requiring significant capital expenditures
5	Remedial actions that may require significant capital expenditures but are not clearly definable at this time

Remedial Actions at Round Butte Hatchery - Spring Chinook

This section presents the corrective actions required to bring the Round Butte Hatchery - Spring Chinook program into compliance with IHOT performance measures. The remedial actions suggested here are just that, suggestions developed by the Montgomery Watson Audit Team. For some non-compliance areas, other remedial actions could be proposed. The required remedial actions are cross-referenced to each IHOT performance measure that was not in compliance. Where appropriate, the costs associated with the remedial actions are also presented (Table 3).

The cost estimates presented in this section are based on professional experience from similar projects. In most cases, only a lump-sum figure is presented, and detailed take-off lists have not been prepared. The cost estimates are essentially order of magnitude estimates ($\pm 40\%$).

More importantly, the suggested remedial activities may also present several levels of action. Optional actions have been listed for several problems. These optional actions are desirable for either operational or safety considerations.

Table 3. Remedial Actions Required at Round Butte Hatchery - Spring Chinook

Remedial Action Required	Cost	PMs¹
Type 1 - Non-compliance issues resulting from items beyond human control or Performance Measures not relevant for this hatchery		
Improve adult returns	----	4h, 42
Install security alarms	----	6
Type 2 - Remedial actions requiring changes in agency policies or procedures		
Develop green-egg to eyed-egg and eyed-egg to fry survival goals for IHOT Operations Plan	----	4d, 4e
Review IHOT temperature criteria for rearing	----	5a
Follow IHOT protocols for checking alarms	----	6
Develop alarm log	----	6
Follow IHOT recommendations for QA/QC for feed preparation	----	12
Follow IHOT protocols for feed handling	----	12
Develop specific incubation and rearing standards for the IHOT Operation Plan	----	18-19
Review IHOT loading and flow criteria for incubation	----	18
Develop smoltification goal and monitor	----	22a1
Follow IHOT recommendations for disinfection of transport equipment before and after use.	----	23
Follow IHOT recommendations for disinfection of tank interiors	----	23
Follow IHOT protocols for disinfection of the exteriors and interiors of vehicles	----	23
Follow IHOT protocols for equipment disinfection	----	23
Follow IHOT protocols for wearing protective garments when handling fish eggs or cultural water	----	23

¹ PMs are performance measures that were extracted from the IHOT 1995 report. The IHOT performance measures are listed in Table 2 (Section 3 of this report) in numerical order.

Remedial Action Required	Cost	PMs ¹
Type 2 (Continued) - Remedial actions requiring changes in agency policies or procedures		
Review IHOT temperature criteria for hauling or change hauling temperature	----	23
Provide foot baths for incubation facilities	----	28
Type 3 - Remedial actions requiring changes in monitoring coverage or interval		
Run analysis for missing water chemistry parameters, nitrite, and contaminants	----	5c, 5f, 5g
Type 4 - Remedial actions requiring significant capital expenditures		
Provide disinfection for incubation and early rearing	\$320,000	5h, 28
Type 5 - Remedial actions that may require significant capital expenditures but are not clearly definable at this time		
Improve pre-spawning survival	----	4b

¹ PMs are performance measures that were extracted from the IHOT 1995 report. The IHOT performance measures are listed in Table 2 (Section 3 of this report) in numerical order.

Hatchery Contribution to Fisheries, Spawning Grounds, and Hatcheries

This section presents the audit findings for the Round Butte Hatchery - Spring Chinook program contribution of adult fish to fisheries, local fisheries, spawning grounds, and hatcheries. Data is reported by broodyear. A broodyear refers to the adult contribution from the eggs produced from a single group of spawning adults. For some species, this may include fish caught as 2-, 3-, 4-, 5-, and 6-year old fish. Because of the return distribution and data processing delays, the complete adult contribution for a given broodyear may not be available until 4 to 5 years after the fish have been released from the hatchery.

**Table 4. Adult Contribution to Fisheries, Spawning Grounds, and Hatcheries:
Round Butte Hatchery - Spring Chinook**

Year	Fisheries¹ (Broodyear)	Spawning Grounds¹ (Broodyear)	Hatchery¹ (Broodyear)	Total Combined Contribution² (Broodyear)	Smolt to Adult Survival (percent)
1981					
1982					
1983	615	?	1395		0.74
1984	1090	?	1301		0.86
1985	845	?	1789		0.99
1986	1177	?	2627		1.43
1987	1234	?	1751		1.09
1988	1631	?	2126		1.44
1989	604	?	1245		0.68
1990	54	?	547		0.22
1991	30	?	668		0.30
1992					

¹ Data obtained from Missing Production Groups Annual Report or from the Regional Mark Information System database.

² Total combined adult contribution; presented when it is not possible to subdivide the contribution into fisheries, spawning grounds, and hatchery contributions.

Annual Operating Expenditures

The level and detail of annual operating expenditures varies widely depending on hatchery, operating agency, and funding source. When provided, expenditures were presented in terms of personnel costs, operating costs (power, feed, supplies), capital costs, indirect costs charged to the federal government, third-party costs, and other costs. These cost components were summed to determine a total hatchery annual cost. Based on discussion with the hatchery manager, the percent of total hatchery costs allocated to a given program was estimated. The total hatchery costs and the percent of hatchery costs allocated to a given program were used to compute the cost of a given program. Table 5 shows the annual operating expenses for the Round Butte Hatchery - Spring Chinook program. For programs that occur at more than one facility (as shown on Table 1 in Section 3 of this report), the cost breakdown for the component(s) at each facility is presented in separate tables (Table 5a).

Table 5. Annual Operating Expenses: Round Butte Hatchery - Spring Chinook

Hatchery	1994	1995	1996
1. Round Butte Hatchery	\$102,801	\$107,877	\$159,252
2.			
3.			
4.			
5.			
Total Program Costs	\$102,801	\$107,877	\$159,252

The total expenditures for the Round Butte Hatchery are presented in Table 6 by program. The detailed breakdown of program expenditures at this hatchery are presented in separate tables (Tables 6a, 6b, and 6c).

Table 6. Annual Operating Expenses - Round Butte Hatchery

Program	1994	1995	1996
1. Summer Steelhead	\$142,779	\$140,839	\$118,658
2. Spring Chinook	\$102,801	\$107,877	\$159,252
3. Brown Trout	\$39,961	\$50,508	\$33,929
4.			
5.			
Total Hatchery Costs	\$285,558	\$299,658	\$312,259

Table 5a. Annual Operating Expenses: Round Butte Hatchery - Spring Chinook
Expenditure Occurring at Round Butte Hatchery

Component	1994	1995	1996
Personnel Costs	\$157,026	\$153,034	\$148,234
Operational Costs	\$85,447	\$100,778	\$120,591
Capital Costs	\$0	\$0	\$0
Indirect Costs	\$43,085	\$45,846	\$43,434
Lumped Hatchery Costs ¹			
Lumped Third-Party Costs			
Total Hatchery Costs	\$285,558	\$299,658	\$312,259
Source of Funds			
PGE and BPA			
Program Production (lb)	28,051	29,902	51,352
Total Production (lb)	78,891	82,864	101,245
Program as Percent of Total	36%	36%	51%
Program Costs	\$102,801	\$107,877	\$159,252

¹ When it was not possible to obtain a detailed cost breakdown from an agency or third party, the undivided costs were entered here.

Table 6a. Detailed Expenditures at Round Butte Hatchery by Program

Summer Steelhead

Component	1994	1995	1996
Personnel Costs	\$157,026	\$153,034	\$148,234
Operational Costs	\$85,447	\$100,778	\$120,591
Capital Costs	\$0	\$0	\$0
Indirect Costs	\$43,085	\$45,846	\$43,434
Lumped Hatchery Costs ¹			
Lumped Third-Party Costs			
Total Hatchery Costs	\$285,558	\$299,658	\$312,259
Source of Funds			
Program Production (lb)	39,800	38,995	38,035
Total Production (lb)	78,891	82,864	101,245
Program as Percent of Total	50%	47%	38%
Program Costs	\$142,779	\$140,839	\$118,658

¹ When it was not possible to obtain a detailed cost breakdown from an agency or third party, the undivided costs were entered here.

Table 6b. Detailed Expenditures at Round Butte Hatchery by Program

Spring Chinook

Component	1994	1995	1996
Personnel Costs	\$157,026	\$153,034	\$148,234
Operational Costs	\$85,447	\$100,778	\$120,591
Capital Costs	\$0	\$0	\$0
Indirect Costs	\$43,085	\$45,846	\$43,434
Lumped Hatchery Costs ¹			
Lumped Third-Party Costs			
Total Hatchery Costs	\$285,558	\$299,658	\$312,259
Source of Funds			
Program Production (lb)	28,051	29,902	51,352
Total Production (lb)	78,891	82,864	101,245
Program as Percent of Total	36%	36%	51%
Program Costs	\$102,801	\$107,877	\$159,252

¹ When it was not possible to obtain a detailed cost breakdown from an agency or third party, the undivided costs were entered here.

Table 6c. Detailed Expenditures at Round Butte Hatchery by Program

Brown Trout

Component	1994	1995	1996
Personnel Costs	\$157,026	\$153,034	\$148,234
Operational Costs	\$85,447	\$100,778	\$120,591
Capital Costs	\$0	\$0	\$0
Indirect Costs	\$43,085	\$45,846	\$43,434
Lumped Hatchery Costs ¹			
Lumped Third-Party Costs			
Total Hatchery Costs	\$285,558	\$299,658	\$312,259
Source of Funds			
Program Production (lb)	11,040	13,967	11,001
Total Production (lb)	78,891	82,864	101,245
Program as Percent of Total	14%	17%	11%
Program Costs	\$39,961	\$50,508	\$33,929

¹ When it was not possible to obtain a detailed cost breakdown from an agency or third party, the undivided costs were entered here.